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CHAPTER 9. TUMOURS OF BONE

TUMOURS OF BONE

Management of Bone. Tumours forms an important segment of orthopaedic practice because of the high rate of mortality in the malignante bone tumours and the high morbidity after ablational surgery or radiation therapy. The incidence of bone tumours is very low (1 to 1.5% of the total malignancies in the body).

In clinical practice true neoplasms of bone will have to be differentiated from hamartomas and reactive bone lesions.

The group of lesions which show abnormal proliferation of cell which soon mature and stop proliferation are called *Hamartomas*. These are really benign *growth disorders* and examples are osteochondroma, osteoma and enchondroma.

Bone alo reacts to many types of injury by new bone formation and this *Reactive* or *Reparative Tissue* can also simulate neoplasis histologically.

One must remember that clinically, certain non neoplastic lesions present as swellings in the bone simulating a tumour e.g. Solitary bone cyst, fibrous dysplasia. Brown tumour lesion in Hyperparathyroidsm etc.

Thus, the diagnosis of bone tumour can be often very difficult. Accurate diagnosis is very important as a mistaken diagnosis of a malignant bone tumour can lead to a very unfortunate result like an unnecessary amputation of the limb.

CLASSIFICATION

True bone tumours can be benign or malignant. A malignant bone rumour is a progressive, invading, metastasizing and nonmaturing proliferation of the cells of the bone tissue.

Bone being a tissue of mesenchymal origin, the abnormality of cell growth can produce a tumour containing not only bone but also cartilage and fibrous tissue in varying degrees. All these are derived from the *primitive multipotent mesenchymal cell*. There is also a group of myelogenic tumours arising from the derivatives of the marrow reticular tissue.

The classification of bone tumours is still not perfect but the following groupings based on their clinical pressentation are useful for diagnostic

purposes. Non inflammatory lesions in the bone may be broadly grouped into Tumour like lesions and True bone tumours.

TUMOUR LIKE LESIONS OF BONE

I. Reactive bone lesions simulating tumours

a. Osteoid osteoma
b, Benign osteoblastoma
c. Non osteogenic fibroma

II. Hamartomas of bone

a. Osteoma
b. Osteochondroma
c. enchondroma

III. Cystic lesions in bone

a. Solitary bone cyst
b. Aneurysmal bone cyst

TRUE BONE TUMOUES

1. Primary Bone Tumours

a. Osteogenic
Osteosarcoma

b. chondrogenic
Chondroblastoma
Chondro myxoid fibroma
Chondrosarcoma

c. Fibro-histiocytic (Connective tissues)

Fibrosarcoma

Malignant Fibrous Histiocytoma

d. Myelogenic

Plasma cell myeloma
Ewing's tumour
Lymphoma of bone

e. Osteoclastoma (Giant cell Tumour)

SECONDARY MALIGNANT DEPOSITS IN BONE

From Primary in:

a. Thyuroid
b. Breast
c. Bronchus
d. Kidney
e. Prostate

A histogenetic classification of bone is based on the type of cell from which a tumour in the bone arises. This is useful to understand the *pathogenesis* of the tumour. Tumours of the bone arise from any of the following type cells constituting bone tissue such as osteoblast, chondroblast and fibroblast. The following the classification based on the basic tissue cell type giving rise to the tumour under general groupings as Benign and Malignan.

On the above hasis the bone tumour could be classified as given in the following Table.

TABLE

Tissue and Cell Type	Benign	Malignant
I. Bone Tissue		
a. Osteoblast	Osteoma Benign Osteoblastoma	Osteosarcoma
b. Chondroblast	Chondroma Chondroblastoma	Chondrosarcoma
c. Fibroblast	Fibroma Non Osteogenis Fibroma	Fibrosarcoma Malignant Osteoclastoma
d. Osteoclast	Osteoclastoma	Malignant Osteoclastoma

II. Periosteal Tissue		
Fibroblast	**Periosteal Fibroma** **Desmoblastic Fibroma of Bone(Desmoid)**	**Periosteal Fibrosarcoma** **Malignant Fibrous Histiocytoma**
III. Bone Marrow Tissue		
a. Undifferentiated Marrow Cell		**Ewing's sarcoma**
b. Plasma Cell		**Solitary Myeloma** **Multiple Myeloma**
c. Reticulo Endothelial Cell		**Reticulum Cell sarcoma**
d. Vascular Tissue	**Haemangioma**	**Haemangioendothelial Sarcoma**
e. Adipose Tissue Fat Cell	**Lipoma**	**Liposarcoma**
f. Nerver Tissue	**Neurofibroma**	**Neurofibrosarcoma**
IV. Synovium		
Tumours arising from pre-existing begin lesion	**Paget's disease of bone**	**Paget's sarcoma**

DIAGNOSIS

The exagnosis of a true tumour of the bone is very important both in therapeutic and prognostic considerations. It is based on 1. clinical examination. A thorough clinical examination eliciting the history and physical signs is the first essential examination. A thorough clinical examination cliciting the history and physical signs is the first essential step. 2. Imaging technology from plain radiography to the modern imaging technologies. 3. Laboratory investigations. 4. Biopsy.

Imaging

Plain radiography still has big role to play in arriving at accurate diagnosis, on the basis of five parameters.

1. The anatomical location of the lesion.

The tumour can be grouped according to th anatomical location as follows:

Diaphyseal : e.g. Ewing's Sarcoma

Diaphysio Metaphyseal : e.g. Chondrosarcoma
Metaphyseal : e.g. Osteosarcoma
Metaphysio Epiphyseal : e.g. Giant Cell Tumour
Aneury smal Bone
Cyst.
Epiphyseal : e.g. Chondroblastoma

2. The borders of the tuour. a. Well defined border, a narrow transitional area and a reactive sclerosis means a benign lesion. b. Poorly defined margins indicate a malignant lesion.

3. Bone destruction of a) geographic pattern (slow growth), b) moth eaten pattern (moderate prowth) or c) permeative pattern (rapid growth)

4. Matrix formation: New bone formation is another parameter to be observed and may vary from woolly masses to dense sclerosis.

5. Periosteal reaction is seen as non continuous and often laminated. e.g. Sunray appearance, Onion peel appearance.

Computerised tomography is useful in the management in all stages, from initial diagnosis to final management and evaluation of dissemination. It denonstrate the extra osseous extension. It also help in early detection of pulmonary secondaries. Magnetic. Reasonance Imaging is a sensitive investigation to assess intramedullary and soft tissue extension of the tumour.

Tc. 99 bone scan is essential for prebiopsy staging studies and also to determine dissemination. Angiogram is done before surgery for operation planning treatment and embolization. More recently. Digital subtraction Angiography (DSA) is being used. In this a real time image of the blood vessels alone is enhanced and the background details of bones and muscles are removed. This demonstrates the vascularity of the tumour.

Laboratory Investigations

Blood investigation: R.B.C., Hb, ESR, VDRL, calcium, inorganic phosphates and alkaline phosphatase must be done. In patients above 40. presenting with osteolytic lesions in bone, serum albumin globulin estimation and serum protein electrophoretic pattern should also be done to exclude multiple myeloma. Acid phosphatase is done for prostate carcinoma. Urine examination is done for Bence Jones protein.

BIOPSY

Biopsy is the most crucial procedure in the diagnosis of musculo skeletal lesions. The appropriate treatment cannot be initiated until the correct tissue diagnosis is available. Prior to the biopsy, all specialists who may ultimately become involved in the patient's care should be consulted as to the staus of work up and prebiopsy differential diagnosis.

Types of Biopsy

Open Biopsy
Closed Biopsy

Open Biopsy

Open biopsy has been the conventional method requiring an incision under operating room conditions. Select the least differentiated or least mineralised portion of the neoplasm. Since this is usually the most representative bortion of a malignant lesion. The periphery of any malignant turnour is the most viable and diagnostic portion of the tumour, whereas the central region is often necrotic. A correctly placed biopsy incision must be capable of being excised enbloc with a malignant tumour when a surgical procedure i.e. limb sparing operation is contemplated.

Closed Biopsy

A closed biopsy implies that no incison is required and that the tissue specimen is obtained through skin puncture by a needle or trephine. It can be done under local anaesthesia and minimises tissue comtamination. Nowadays trocar biopsy is used widely. It cannot be done in osteosclerotic bone tumpurs. Mittal (Patiala) has devised the Patiala biopsy needle which is used for closed biopsy.

CT Assisted Needle Biopsy

Accurate localisation of the tumour in sites like the spine and pelvis by CT enable closed biopsy of these lesions. This avoids major surgical procedures for biopsy purposes. This can also be done with image intensifier.

GRADING AND SURGICAL STAGING SYSTEM

With progress in the Radiotherapeutic modalities and more effective Chemotherapy, better therapeutic programmes are now possible. In this situation it becomes necessary to have a Staging system for the bone tumours accepted internationally as in the case or Soft tissue malignancy.

Enneking (1980) has evolved a system of Surgical Staging of bone tumours. This is based on the histological grade (G) anatomical location (T) and the presence of secondary metastasis (M) This system provides guidelines and protocol for surgical and other therapy as well as for assessing prognosis.

Grade (G)

Grade 1. lesion are those with low grade malignancy. Histologically they show few mitosis little anaplasia and cellular atypia Grade 2 are of high grade malignancy. They show poorly differentiated cells with marked atypism and plemorphism. Cells are hyperchromatic with more frequent mitosis.

Site (T)

The second parameter standardised by Enneking is the anatomical location in relation to the tissue compartments.T1 lesion is intra compartmental confined within the cortical boundaries of a bone like fermur of tibia. In extracompartmental (T2) lesions, the natural barriers are crossed and the lesion involves mor than one compartment.

Metastasis (M)

MO and M1 refers to the absence or presence of metastasis.

Surgical Stages

SURGICAL MARGINS